What is claimed is:

1. An optical multilayer structure comprising:

a substrate;

a light-absorbing first layer;

a gap portion having a changeable size capable of causing an optical interference phenomenon; and

a second layer.

2. An optical multilayer structure according to claim 1, wherein the first layer, the gap portion, and the second layer are stacked in accordance with this order on the substrate.

3. An optical multilayer structure according to claim 1, wherein when a complex index of refraction of the substrate is N_s ($= n_s - i \cdot k_s$, where n_s denotes a refractive index, k_s denotes an extinction coefficient, and i represents an imaginary unit), a complex index of refraction of the first layer is N_1 ($= n_1 - i \cdot k_1$, where n_1 denotes a refractive index, and k_1 denotes an extinction coefficient), a refractive index of the second layer is n_2, and a refractive index of an incident medium is 1.0, the relation of the following Expression (1) is satisfied.

$$\{(n_1-(n_2^2+1)/2)^2+k_1^2-((n_2^2-1)/2)^2\}\{(n_s-(n_2^2+1)/2)^2+k_s^2-((n_2^2-1)/2)^2\} < 0 \qquad \text{...(1)}$$

4. An optical multilayer structure according to claim 1, wherein the second layer is made of a transparent material.

5. An optical multilayer structure according to claim 1, wherein the substrate is a light-absorbing substrate or a substrate on which a light absorbing film is formed.

6. An optical multilayer structure according to claim 1, wherein the substrate is made of a transparent material or a translucent material.

7. An optical multilayer structure according to claim 1, further comprising driving means for changing an optical size of the gap portion,

wherein the size of the gap portion is changed by the driving means, thereby changing an amount of reflection, transmission, or absorption of incident light.

8. An optical multilayer structure according to claim 7, wherein the optical size of the gap portion is changed by the driving means in a binary manner or continuously between an odd multiple of $\lambda/4$ and an even multiple of $\lambda/4$ (including 0), thereby changing the amount of reflection, transmission, or absorption of incident light in a binary manner or continuously.

9. An optical multilayer structure according to claim 1, wherein at

least one of the first and second layers is a composite layer made of two or more layers having optical characteristics different from each other.

10. An optical multilayer structure according to claim 4, wherein the second layer is a silicon nitride film.

11. An optical multilayer structure according to claim 10, wherein the second layer is made by a silicon nitride layer and a transparent conductive layer.

12. An optical multilayer structure according to claim 7, wherein at least one of the first and second layers partly includes a transparent conductive layer, and the driving means changes the optical size of the gap portion by an electrostatic force generated by application of a voltage to the transparent conductive film.

13. An optical multilayer structure according to claim 12, wherein the transparent conductive film is made of ITO, SnO_2, or ZnO.

14. An optical multilayer structure according to claim 1, wherein the gap portion is filled with air, transparent gas, or transparent liquid.

15. An optical multilayer structure according to claim 1, wherein the gap portion is in vacuum.

16. An optical multilayer structure according to claim 1, wherein the light-absorbing first layer is made of any one of metal, metal oxide, metal nitride, carbide, and semiconductor.

17. An optical multilayer structure according to claim 5, wherein the light-absorbing substrate or light-absorbing thin film is made of any one of metal, metal oxide, metal nitride, carbide, and semiconductor.

18. An optical multilayer structure according to claim 1, wherein an optical thickness of the second layer is $\lambda/4$ or less (λ: design wavelength of incident light).

19. An optical multilayer structure according to claim 1, wherein the first layer is made of silicon and the optical thickness of the second layer is $\lambda/2$ or less (λ: design wavelength of incident light).

20. An optical multilayer structure according to claim 1, wherein the substrate is made of carbon, graphite, carbide, or a transparent material, and the optical thickness of the second layer is $\lambda/4$ or less (λ: design wavelength of incident light).

21. An optical multilayer structure according to claim 1, wherein the substrate is made of carbon, graphite, carbide, or a transparent material,

the first layer is made of silicon, and the optical thickness of the second layer is $\lambda/4$ or less (λ: design wavelength of incident light).

22. An optical multilayer structure according to claim 7, wherein the driving means changes an optical size of the gap portion by using a magnetic force.

23. An optical multilayer structure comprising:

a substrate;

a light-absorbing first layer formed in contact with the substrate; and

a second layer formed in contact with a face of the first layer, on the side opposite to the substrate.

24. An optical multilayer structure according to claim 23, wherein the substrate is a substrate which does not transmit light.

25. An optical switching device comprising:

an optical multilayer structure having a substrate, a light-absorbing first layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, and a second layer; and

driving means for changing an optical size of the gap portion.

26. An image display for displaying a two-dimensional image by

irradiating a plurality of optical switching devices arranged one-dimensionally or two-dimensionally with light,

the optical switching device comprising:

an optical multilayer structure having a substrate, a light-absorbing first layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, and a second layer; and

driving means for changing an optical size of the gap portion.

27. An optical multilayer structure comprising:

a light-absorbing layer, portion, or substrate which does not transmit incident light or a transparent substrate;

a first transparent layer made of a material having a low refractive index;

and a second transparent layer made of a material having a high refractive index;

the first and the second transparent layers being stacked in accordance with this order on the layer, portion, or substrate or the transparent substrate; and

a gap portion having a changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the first transparent layer, or between the first and second transparent layers.

28. An optical multilayer structure according to claim 27, wherein a

refractive index n_m and an extinction coefficient k_m (which is 0 in the case of the transparent substrate) of the light-absorbing layer, portion, or substrate or the transparent substrate satisfy the relations of the following expressions (2) and (3), respectively.

$1 \leq n_m \leq 5.76$ ... (2)

$k_m \leq \sqrt{5.66-(n_m-3.38)^2}$ ... (3)

29. An optical multilayer structure according to claim 27, further comprising driving means for changing an optical size of the gap portion,

wherein the size of the gap portion is changed by the driving means, thereby changing a reflection amount of light entering from a side opposite to the lightabsorbing layer, portion, or substrate or the transparent substrate.

30. An optical multilayer structure according to claim 27, wherein an optical thickness of the first and second transparent layers is λ/4 or less (λ: design wavelength of incident light).

31. An optical multilayer structure according to claim 27, wherein the first transparent layer having a low refractive index is a gap portion.

32. An optical multilayer structure according to claim 29, wherein the optical size of the gap portion is changed by the driving means in a binary manner or continuously between an odd multiple of λ/4 and an even

multiple of $\lambda/4$ (including 0), thereby changing the amount of reflection of incident light in a binary manner or continuously.

33. An optical multilayer structure according to claim 27, wherein the layer, portion, or substrate which absorbs incident light is made of metal, metal nitride, semiconductor, or opaque oxide.

34. An optical multilayer structure according to claim 27, wherein at least one of the first and second transparent layers is a composite layer made of two or more layers having optical characteristics different from each other.

35. An optical multilayer structure according to claim 27, wherein a part of at least one of the first and second transparent layers is a transparent conductive film, and the driving means changes the optical size of the gap portion by an electrostatic force generated by application of a voltage to either across the two transparent conductive films, or across the transparent conductive film and the conductive layer, portion, or substrate.

36. An optical multilayer structure according to claim 35, wherein the transparent conductive film is made of ITO, SnO_2, or ZnO.

37. An optical multilayer structure according to claim 27, wherein the

gap portion is filled with air, transparent gas, or transparent liquid.

38. An optical multilayer structure according to claim 27, wherein the gap portion is in vacuum.

39. An optical multilayer structure according to claim 28, wherein the driving means changes the optical size of the gap portion by using a magnetic force.

40. An optical multilayer structure comprising:

a light-absorbing layer, portion, or substrate which does not transmit incident light;

a first transparent layer made of a material having a high refractive index;

a second transparent layer made of a material having a low refractive index;

a third transparent layer made of a material having a high refractive index;

the first, second, and third transparent layers being stacked in accordance with this order on the layer, portion, or substrate,

and

a gap portion having a changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the first transparent layer, between the

first and second transparent layers, or between the second and third transparent layers.

41. An optical multilayer structure according to claim 40, wherein a refractive index n_m and an extinction coefficient k_m of the light-absorbing layer, portion, or substrate satisfy the relations of the following expressions (4) and (5), respectively, and do not satisfy the relations of the following expressions (6) and (7), respectively.

$0.33 \leq n_m \leq 17.45$ ... (4)

$km \leq \sqrt{73.27-(n_m-8.89)^2}$ ... (5)

$1 \leq n_m \leq 5.76$ ... (6)

$km \leq \sqrt{5.66-(n_m-3.38)^2}$ ... (7)

42. An optical multilayer structure according to claim 40, further comprising driving means for changing an optical size of the gap portion,

wherein the size of the gap portion is changed by the driving means, thereby changing a reflection amount of light entering from a side opposite to the light-absorbing layer, portion, or substrate which does not transmit incident light.

43. An optical multilayer structure according to claim 40, wherein an optical thickness of the first and second transparent layers is $\lambda/2$ or less (λ: design wavelength of incident light).

44. An optical multilayer structure according to claim 43, wherein an optical thickness of the third transparent layer is $\lambda/4$ (λ: design wavelength of incident light).

45. An optical multilayer structure according to claim 40, wherein the optical size of the gap portion is changed by the driving means in a binary manner or continuously between an odd multiple of $\lambda/4$ and an even multiple of $\lambda/4$ (including 0), thereby changing the amount of reflection of incident light in a binary manner or continuously.

46. An optical multilayer structure according to claim 40, wherein the layer, portion, or substrate which absorbs incident light is made of metal, metal nitride, semiconductor, or opaque oxide.

47. An optical multilayer structure according to claim 40, wherein at least one of the second and third transparent layers is a composite layer made of two or more layers having optical characteristics different from each other.

48. An optical multilayer structure according to claim 40, wherein a part of at least one of the second and third transparent layers is a transparent conductive film, and the driving means changes the optical size of the gap portion by an electrostatic force generated by application of a voltage to either across the two transparent conductive films, or across

the transparent conductive film and the conductive layer, portion, or substrate.

49. An optical multilayer structure according to claim 48, wherein the transparent conductive film is made of ITO, SnO_2, or ZnO.

50. An optical multilayer structure according to claim 40, wherein the gap portion is filled with air, transparent gas, or transparent liquid.

51. An optical multilayer structure according to claim 40, wherein the gap portion is in vacuum.

52. An optical multilayer structure according to claim 42, wherein the driving means changes the optical size of the gap portion by using a magnetic force.

53. An optical switching device comprising:

an optical multilayer structure having a light-absorbing layer, portion, or substrate which does not transmit incident light or a transparent substrate, a first transparent layer made of a material having a low refractive index, a second transparent layer made of a material having a high refractive index, the first and second transparent layers being stacked in accordance with this order on the layer, portion, or substrate or the transparent substrate, and a gap portion having a

changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the first transparent layer, or between the first and second transparent layers; and

driving means for changing an optical size of the gap portion.

54. An optical switching device according to claim 53, wherein a refractive index n_m and an extinction coefficient k_m of the light-absorbing layer, portion, or substrate which does not transmit incident light or the transparent substrate satisfy the relations of the following expressions (8) and (9), respectively.

$1 \leq n_m \leq 5.76$ ... (8)

$km \leq \sqrt{5.66 - (n_m - 3.38)^2}$ ... (9)

55. An optical switching device comprising:

an optical multilayer structure having a light-absorbing layer, portion, or substrate which does not transmit incident light, a first transparent layer made of a material having a high refractive index, a second transparent layer made of a material having a low refractive index, a third transparent layer made of a material having a high refractive index, the first, second, and third transparent layers being stacked in accordance with this order on the layer, portion, or substrate, and a gap portion having a changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the

first transparent layer, between the first and second transparent layers, or between the second and third transparent layers; and

driving means for changing an optical size of the gap portion.

56. An optical switching device according to claim 55, wherein a refractive index n_m and an extinction coefficient k_m of the light-absorbing layer, portion, or substrate satisfy the relations of the following expressions (10) and (11) respectively, and do not satisfy the relations of the following expressions (12) and (13), respectively.

$0.33 \leq n_m \leq 17.45$ ... (10)

$km \leq \sqrt{73.27-(n_m-8.89)^2}$ ... (11)

$1 \leq n_m \leq 5.76$ ... (12)

$km \leq \sqrt{5.66-(n_m-3.38)^2}$ ... (13)

57. An image display for displaying a two-dimensional image by irradiating a plurality of optical switching devices arranged one-dimensionally or two-dimensionally with light,

the optical switching device comprising:

an optical multilayer structure having a light-absorbing layer, portion, or substrate which does not transmit incident light or a transparent substrate, a first transparent layer made of a material having a low refractive index, a second transparent layer made of a material having a high refractive index, the first and second transparent layers being stacked in accordance with this order on the layer, portion, or

substrate or the transparent substrate, and a gap portion having a changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the first transparent layer, or between the first and second transparent layers; and

driving means for changing an optical size of the gap portion.

58. An image display for displaying a two-dimensional image by irradiating a plurality of optical switching devices arranged one-dimensionally or two-dimensionally with light,

the optical switching device comprising:

an optical multilayer structure having a light-absorbing layer, portion, or substrate which does not transmit incident light, a first transparent layer made of a material having a high refractive index, a second transparent layer made of a material having a low refractive index, a third transparent layer made of a material having a high refractive index, the first, second, and third transparent layers being stacked in accordance with this order on the layer, portion, or substrate, and a gap portion having a changeable size capable of causing an optical interference phenomenon, provided between the light-absorbing layer, portion, or substrate and the first transparent layer, between the first and second transparent layers, or between the second and third transparent layers; and

driving means for changing an optical size of the gap portion.

59. An optical multilayer structure comprising:

a transparent substrate made of a non-metallic material;

a first transparent layer in contact with the transparent substrate;

a gap portion having a changeable size capable of causing an optical interference phenomenon; and

a second transparent layer,

the first transparent layer, the gap portion, and the second transparent layers being stacked in accordance with this order on the transparent substrate,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, and a refractive index of the second transparent layer is n_2, the relation of $n_s < n_1$ and the relation of $n_1 > n_2$ are satisfied.

60. An optical multilayer structure according to claim 59, further comprising driving means for changing an optical size of the gap portion,

wherein the size of the gap portion is changed by the driving means, thereby changing an amount of reflection or absorption of incident light entered from the transparent substrate side or a side opposite to the transparent substrate.

61. An optical multilayer structure according to claim 60, wherein an optical thickness of the first and second transparent layers is $\lambda/4$ or an odd multiple of $\lambda/4$ (λ: wavelength of incident light).

62. An optical multilayer structure according to claim 61, wherein the optical size of the gap portion is changed by the driving means in a binary manner or continuously between an odd multiple of $\lambda/4$ and an even multiple of $\lambda/4$ (including 0), thereby changing the amount of reflection or transmission of incident light in a binary manner or continuously.

63. An optical multilayer structure according to claim 59, wherein the value of n_2 is $n_1/\sqrt{n_s}$.

64. An optical multilayer structure according to claim 1, wherein at least one of the first and second transparent layers is a composite layer made of two or more layers having optical characteristics different from each other.

65. An optical multilayer structure according to claim 64, wherein a part of each of the first and second transparent layers is a transparent conductive layer, and the driving means changes the optical size of the gap portion by an electrostatic force generated by application of a voltage to the transparent conductive film.

66. An optical multilayer structure according to claim 65, wherein the transparent conductive film is made of ITO, SnO_2, or ZnO.

67. An optical multilayer structure according to claim 59, wherein the gap portion is filled with air, transparent gas, or transparent liquid.

68. An optical multilayer structure according to claim 67, wherein the gap portion is filled with a liquid, and functions as a layer having a low refractive index, an intermediate refractive index, or a high refractive index.

69. An optical multilayer structure according to claim 59, wherein the gap portion is in vacuum.

70. An optical multilayer structure according to claim 60, wherein the driving means changes an optical size of the gap portion by using a magnetic force.

71. An optical multilayer structure comprising:

a transparent substrate made of a non-metallic material;

a first transparent layer in contact with the transparent substrate;

a second transparent layer;

a gap portion having a changeable size capable of causing an optical interference phenomenon;

a third transparent layer; and

a fourth transparent layer,

the first and second transparent layers, the gap portion, and the

third and fourth transparent layers being stacked in accordance with this order on the transparent substrate,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, a refractive index of the second transparent layer is n_2, a refractive index of the third transparent layer is n_3, and a refractive index of the fourth transparent layer is n_4, the relation of $n_s < n_1 < n_2 \fallingdotseq n_3$ and the relation of $n_4 < n_1$ are satisfied.

72. An optical multilayer structure according to claim 71, further comprising driving means for changing an optical size of the gap portion,

wherein the size of the gap portion is changed by the driving means, thereby changing an amount of reflection or transmission of incident light entered from the transparent substrate side or a side opposite to the transparent substrate.

73. An optical multilayer structure according to claim 71, wherein an optical thickness of the first, second, third, and fourth transparent layers is $\lambda/4$ or an odd multiple of $\lambda/4$ (λ: wavelength of incident light).

74. An optical multilayer structure according to claim 71, wherein the optical size of the gap portion is changed by the driving means in a binary manner or continuously between an odd multiple of $\lambda/4$ and an even multiple of $\lambda/4$ (including 0), thereby changing the amount of reflection or

transmission of incident light in a binary manner or continuously.

75. An optical multilayer structure according to claim 71, wherein the first transparent layer is a composite layer made of a thin film made of a material having a high refractive index and a thin film made of a material having a low refractive index.

76. An optical multilayer structure according to claim 71, wherein at least one of the first to fourth transparent layers is a composite layer made of two or more layers having optical characteristics different from each other.

77. An optical multilayer structure according to claim 76, wherein a part of each of at least two transparent layers sandwiching the gap portion out of the first to fourth transparent layers is a transparent conductive film, and the driving means changes the optical size of the gap portion by an electrostatic force generated by application of a voltage to the transparent conductive film.

78. An optical multilayer structure according to claim 77, wherein the transparent conductive film is made of ITO, SnO_2, or ZnO.

79. An optical switching device comprising:

an optical multilayer structure having a transparent substrate

made of a non-metallic material, a first transparent layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, and a second transparent layer, the first transparent layer, the gap portion, and second transparent layer being stacked in accordance with this order on the transparent substrate; and

driving means for changing an optical size of the gap portion,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, and a refractive index of the second transparent layer is n_2, the relation of $n_s < n_1$ and the relation of $n_1 > n_2$ are satisfied.

80. An optical switching device comprising:

an optical multilayer structure having a transparent substrate made of a non-metallic material, a first transparent layer, a second transparent layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, a third transparent layer, and a fourth transparent layer, the first and second transparent layers, the gap portion, and the third and fourth transparent layers being stacked in accordance with this order on the transparent substrate; and

driving means for changing an optical size of the gap portion,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, a refractive index of the second transparent layer is n_2, a refractive index of the third transparent layer is n_3, and a refractive index of the fourth transparent

layer is n_4, the relation of $n_s < n_1 < n_2 \fallingdotseq n_3$ and the relation of $n_4 < n_1$ are satisfied.

81. An image display for displaying a two-dimensional image by irradiating a plurality of optical switching devices arranged one-dimensionally or two-dimensionally with light,

the optical switching device comprising:

an optical multilayer structure having a transparent substrate made of a non-metallic material, a first transparent layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, and a second transparent layer, the first transparent layer, the gap portion, and the second transparent layer being stacked in accordance with this order on the transparent substrate; and

driving means for changing an optical size of the gap portion,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, and a refractive index of the second transparent layer is n_2, the relation of $n_s < n_1$ and the relation of $n_1 > n_2$ are satisfied.

82. An image display for displaying a two-dimensional image by irradiating a plurality of optical switching devices arranged one-dimensionally or two-dimensionally with light,

the optical switching device comprising:

an optical multilayer structure having a transparent substrate

made of a non-metallic material, a first transparent layer, a second transparent layer, a gap portion having a changeable size capable of causing an optical interference phenomenon, a third transparent layer, and a fourth transparent layer, the first and second transparent layers, the gap portion, and the third and fourth transparent layers being stacked in accordance with this order on the transparent substrate; and

driving means for changing an optical size of the gap portion,

wherein when a refractive index of the transparent substrate is n_s, a refractive index of the first transparent layer is n_1, a refractive index of the second transparent layer is n_2, a refractive index of the third transparent layer is n_3, and a refractive index of the fourth transparent layer is n_4, the relations of $n_s < n_1 < n_2 \fallingdotseq n_3$ and the relation of $n_4 < n_1$ are satisfied.